Title: Which Box Is Best?

Brief Overview:

Students are trying to raise money for a field trip to a new jelly bean factory. They will use fractions, volume, reasoning, and their knowledge of money to determine which size box of jelly beans they will sell during their fund-raiser.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will work to find the best value by applying their knowledge of fractions, money, and volume to discover which size box (individual size or family size) should be sold for their class fund-raiser.

- **Mathematics as Communication**
  Students will demonstrate their understanding of fractions in the creation of a business letter explaining which size box is the best value to purchase. Within the business letter students will explain how they reached their conclusion and give suggestions on how the head of the jelly bean company can make his boxes a better value.

- **Mathematics as Reasoning**
  Students will share strategies they used to determine their results in classroom discussions and their business letters. Their thinking processes will be examined through their explanations, classroom discussions, individual work, and their written responses in the business letters.

- **Mathematical Connections**
  Students will use mathematical strategies to solve a real-world problem. They will make connections to language arts by writing to inform. Students will write a business letter to the head of the jelly bean company informing him/her of their findings.

- **Estimation**
  Students will estimate the number of jelly beans in each box. They also will determine which strategy is appropriate to use when estimating how the individual size box compares as a fraction to the family size box.

- **Number Sense and Numeration**
  Students will use number sense to determine the volume of the two boxes. Also, the students need to create fractions to make decisions.

- **Whole Number Computation**
  Students will use multiplication to find the volumes of the different boxes. The students will also use multiplication to discover how the individual size box compares to the family size box in price.

- **Geometry and Spatial Sense**
  Students will look at and compare examples of different size jelly bean boxes. They will also use rainbow unit cubes to model the examples shown to determine volume.

- **Measurement**
  Students will use measurement to determine the volumes of two different size jelly bean boxes and to create their own boxes.

- **Fractions and Decimals**
  Students will apply their knowledge of fractions to discover how many individual boxes can fit into the family size box. Students will also discover how many jelly beans from the individual box compare fractionally to the number of jelly beans in the family size box. Students will also apply their knowledge of fractions when taking a classwide vote to determine which box will be used for the fund-raiser.

- **Patterns and Relationships**
  Students will study the relationships between different size jelly bean boxes by comparing volumes using unit cubes, fractions using models of jellybean boxes, and money through the determination of which jellybean box is the best value.

Grade/Level:

4th - 5th grades

Duration:

This performance task will take 2-3 50 minute class periods.

Prerequisite Knowledge:

Students should have working knowledge of the following skills (for example):

- Estimating, rounding and place value
- Constructing fractions
- Money
- Volume
- Measurement
- Multiplication

Objectives:

Students will:

- work cooperatively in groups to accomplish a common goal.
- estimate before calculating utilizing a variety of strategies.
- apply fractions to real life situations.
- express fractions in simplest form.
- explain reasoning behind the decisions they make.
- express given volumes of boxes using fractions.
- examine given data and draw conclusions.
- use manipulatives to model the concept of volume.
- write to inform by completing a business letter.
- compare prices of different size boxes to make a decision.

Materials/Resources/Printed Materials:

- Rainbow unit cubes (prepared in packets; students will work in pairs with the cubes)
- Student and teacher resource sheets
- Facsimile of individual size box and family size box on transparency (look at worksheet)
- Rulers
- Crayons/colored pencils
- Math Explorer Calculators (for students who need additional support)

- Jelly bean boxes (one family size and one individual size)
- Scissors
- Chart paper

Development/Procedures:

Engagement Activity

Show students a pamphlet from the new Jelly Beanie Factory (Teacher Resource Sheet 1). Tell the students that you had wanted to take the class on a field trip there, but the school does not have the funding. Then tell them that you called the head of the factory. He agreed to send us free boxes of Jelly Beanies to sell so that we can afford to go on a tour of the factory. Now we have to decide which size box we are going to sell -- the family size box or the individual size box.

Lesson Development

Show the actual family size box and individual size box. Have the students estimate the number of jelly beans that are in the family size box.

Show the "inside" view of the family size box on the overhead. It will show length, width, and height (see Teacher Resource Sheet 2 and 3 to make transparencies). In partners, have the students recreate the model using the rainbow unit cubes at their desks. Ask the students to find out how many jelly beans are in the box. Have students share their responses and communicate how they reached their answer. Have students look at their estimations to see how their actual numbers (volumes) compare.

Next have the students look at the actual individual size box. Estimate the number of jelly beans in this size box. Show inside view of individual size box. Students will once again use rainbow unit cubes to find the volume of the box. Have the students share their responses and communicate how they arrived at their answer. Have the students look at their estimation to see how the actual number of jelly beans in the individual size box compares.

Have the students brainstorm comparisons of the two volumes (family size -- 360, individual size-- 90) to find relationships. Ask the students which box they would rather buy and why. Show the students the actual price of each box (see price tags on Teacher Resource Sheet 4). Ask again which box the students would rather buy and why. Ask if anyone had changed their minds and why. Ask which box would be the better value to order. Ask students to explain their thinking.

Ask how many individual boxes can we fit into the larger size box. Show the students a "bird's eye view" of the family size box and the individual size box. Have students cut out shapes of the top of each box and use them to see how many times the individual size box can fit into the family size box (Teacher Resource Sheet 5). Have a student volunteer demonstrate this on the overhead using a transparency of the box tops. Ask the students how many individual size boxes they would need to completely fill the family size box (4 boxes). Have the students write a fraction that shows how much space the individual size box covers when compared to the family box (1/4). Have the students record the fraction and explain how they got their answer in sentence form.

Ask the students, "If each individual size box is 1/4 the size of the family size box and the individual size box cost $2.00, which box is the better value--the family size or individual size box?" Show this question on the overhead (Teacher Resource Sheet 6).

For additional support, ask, "How many smaller boxes are needed to fit in the larger box? (4) So, how much would it cost to buy enough individual boxes to equal the volume of the family size box ($2.00 x 4 = $8.00)?" Have the students compare the price of one family size box to the total price of how many individual size boxes they would need to fill the family size box. Discuss the relationship between the two prices. Have the students answer this question and explain their reasoning in their math journals.

Assessment Activities

Have the students answer the stance questions about their findings (Teacher Resource Sheet 7). Discuss student responses to the questions.

Take a secret vote (this means that students have their heads down and eyes closed so they may not see how others are voting) on which type of box they would rather buy. Record results on chart paper. Have the students change the numbers into fractions. For example, if five out of twenty-four students voted for individual size boxes, then the fraction would be 5/24.

Next, students will write a business letter to the head of the Jelly Beanie Company. The students will tell the company which size box their class would like to order and why. Then, students must explain why they chose the box they did and how they got their answer. In a separate paragraph, the students must give at least two suggestions, based on what was learned, that they have for the head of the company on how he could make his boxes better values. (Teacher Resource Sheets 8, 9, and 10).

Using the suggestions that they wrote in their letters, have the students create and design their own individual and family size boxes. For each box, the student must draw and record the volume (l x w x h) somewhere on the box. Then, the students must compare the sizes of their two boxes and create a fraction based on the different sizes of the two boxes. For example, one student generated family size box may equal five student generated individual size boxes. Students may want to use rainbow unit cubes to model the size of their two boxes so as to make visual comparisons easier. Next, the students must establish prices for each size box. The price on box must reflect the size of the box. For example, the individual size box is 1/5 of the size of the family size box and the cost of a family size box is $5.00, then the price of the individual size box must be 1/5 of the $5.00 price. Therefore, the price of the individual size box must be $1.00. Have students explain how they reached their answer in paragraph form (see rubric on Teacher Resource Sheet 11).

Performance Assessment:

Students can be evaluated based on the following:

- Participation and performance in pairs and in whole group discussions
- Appropriate use of mathematical language throughout the unit
- Written explanation in journal reflections
- Answers to stance questions
- Response to business letter prompt
- Student created boxes

Extension/Follow Up:

- Have the students research information about jelly beans on the Internet.
- Use jelly beans in a probability activity (sort by color/flavor, write fractions, graph, etc.).

- Have the students estimate the number of jelly beans in a large container at the beginning of the week. The student with the closest estimation gets to take home all of the jelly beans on Friday.
- Create a circle graph using the colors of the jelly beans in a bag. Have students place their color jelly beans on the outside of a large circle graph on the floor. Find fractions, decimals, and percentages of the different colors on the circle graph.
- Find the mean, median, and mode of the different colors in a bag of jelly beans.
- Create a frequency chart of favorite jelly bean flavors. Have the students create pictographs, line graphs, and bar graphs using the frequency chart.
- Have the students act out an advertisement for the jelly bean company (commercial, radio broadcast, etc.).
- Design a web page with information about the company and their different size boxes. Include information discovered during the unit on the web page.
- After reading Jack Prelutsky's poem about unusual ice-cream flavors, create your own jelly bean flavor. Write a descriptive paragraph about your jelly bean. Have the students share their paragraphs.

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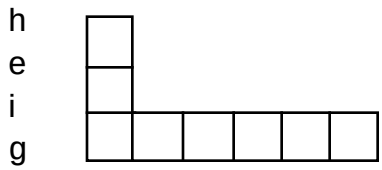
- Root Bear... brown
- White Chocolate Mousse white
- Mango... orange
- Seaweed... green
- Boston Cream Pie... speckled yellow
- Caramel Apple... light green

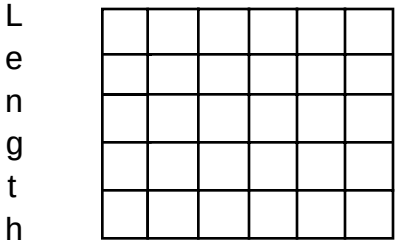
(Teacher Resource Sheet 2)

Inside View of Individual Size Box



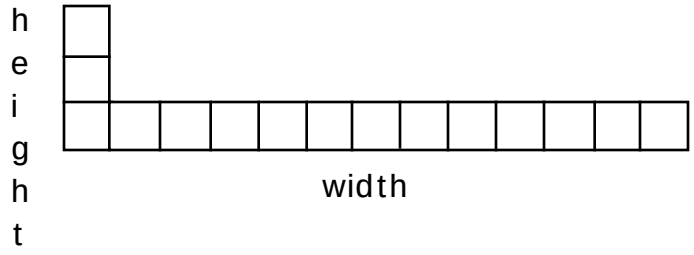
Side View of Individual Size Box

“Bird’s Eye View”

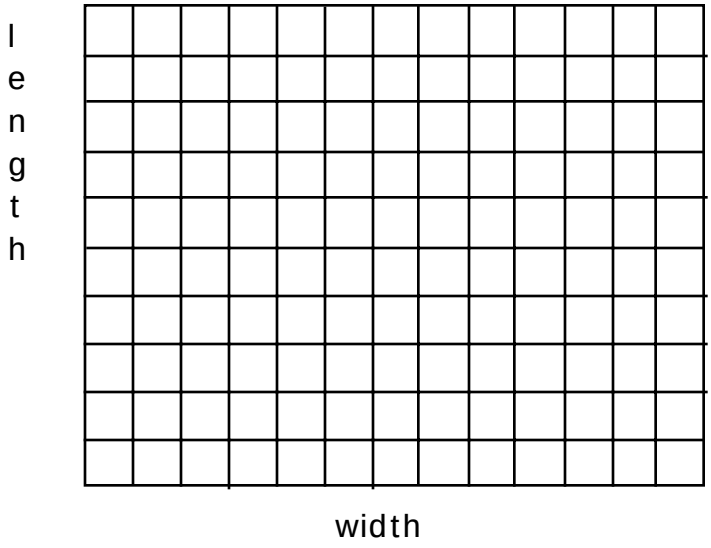


(Teacher Resource Sheet 3)

Inside View of Family Size Box



“Bird’s Eye View”

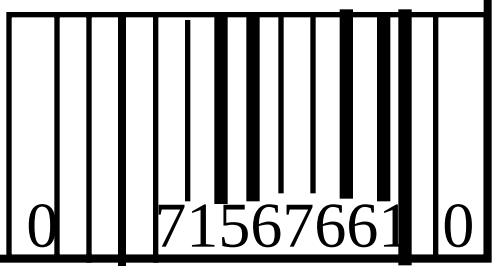


Teenie

Jelly Beanies

Individual size

$ 2.00

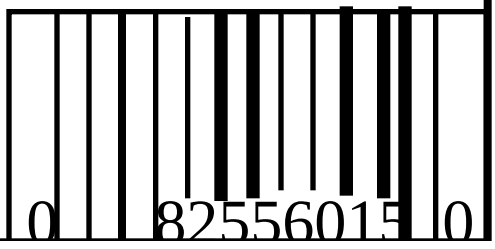


Jumbo

Jelly Beanies

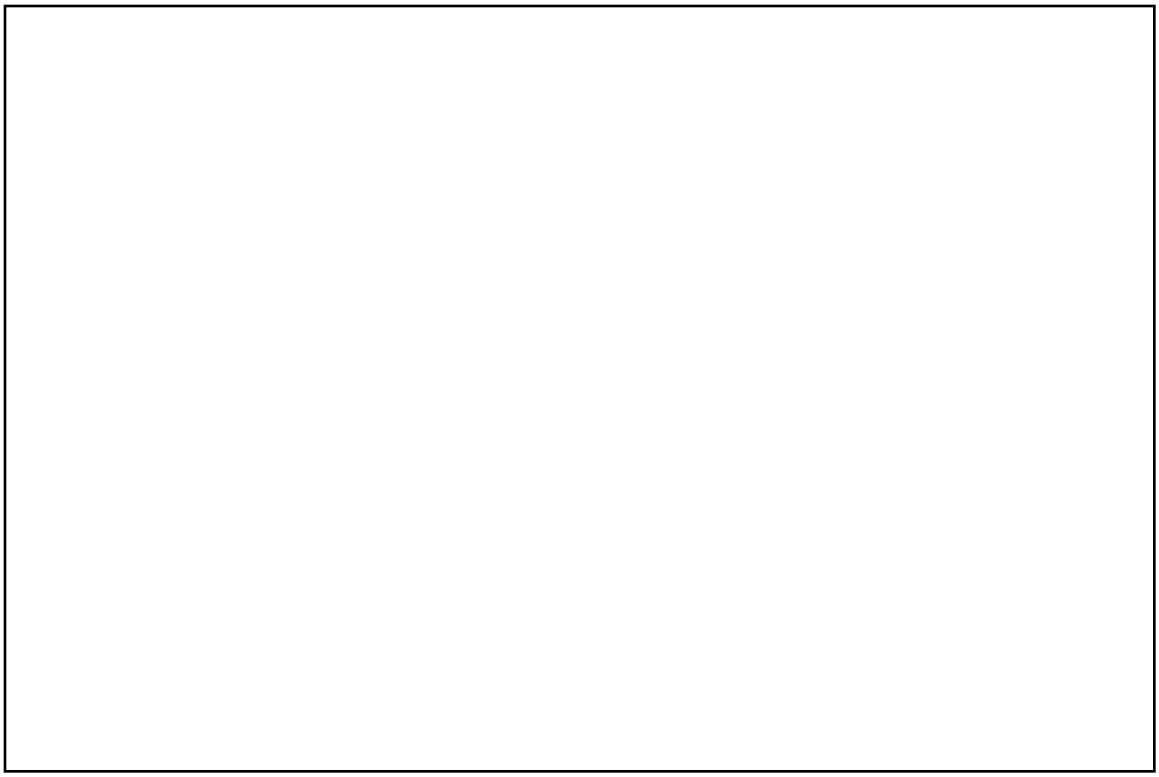
Family size

$ 4.00

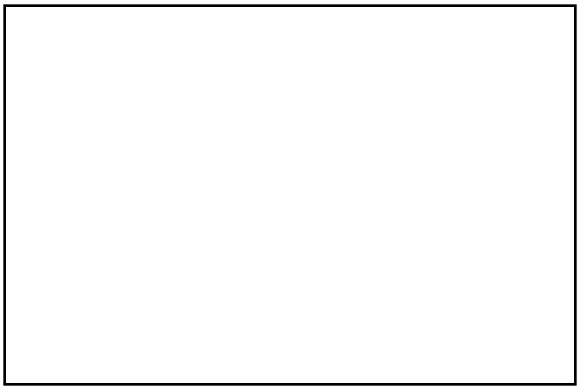


(Teacher Resource Sheet 5)

Family Size Jelly Beanie Box



Individual Size Jelly Beanie Box



1. How many individual size boxes completely fill one family size box?

2. Write a fraction to show how the size of the individual size box compares to the family size box.

(Teacher Resource 6)

Math Journal

If each individual size box is 1/4 the size of the family size box and the individual size box costs $2.00, which box is the better value--the family size box or the individual size box? Explain your answer.

(Teacher Resource Sheet 7)

Which Box Is Best?

Stance Questions

Directions: Answer each question in a complete sentence.

1. **How did your estimates compare with the actual volume of the boxes?**

   individual size box:

   family size box:

2. **Explain which box is the better value and why?**

3. **Why do you think the company priced the boxes the way they did?**

4. **How would you make the boxes a better value?**

Which Box Is Best?

Writing Prompt

Write a business letter to the head of the Jelly Beanie company. Tell the company which size box you think our class should order and why. Explain why you chose the box you did and how you got your answer. In another paragraph, give at least two suggestions, based on what we discovered today, that you have for the head of the company on how we can make his/her boxes better values. Be sure to include math vocabulary, correct capitalization, word usage, punctuation, and spelling in your writing.

(Teacher Resource Sheet 9)

Business Letter Template

Checklist for Business Letter

1. _____ Student uses correct business letter format.
2. _____ Student uses correct audience.
3. _____ Student states which box they would order.
4. _____ Student explains reasoning for box choice.
5. _____ One suggestion is given for the head of the company.
6. _____ A second suggestion is given for the head of the company.
7. _____ Student uses correct capitalization.
8. _____ Student uses correct word usage.
9. _____ Student uses correct punctuation.
10. _____ Student has two or fewer spelling errors.

Points earned: _____

Total points: _____

Final Grade: _____

Teacher comments: _____

_____

_____

Student Created Boxes
Rubric

3	**Student drew and recorded volume for each box.** **Student created fractions for both boxes.** **Prices on each box reflect the size of the box.** **Student uses appropriate math vocabulary.** **Student clearly explains thinking.**
2	**Student solves the problem or answers the questions correctly.** **Student uses some math vocabulary.** **Student uses some drawings, labels, tables, or diagrams.** **Student explains thinking with some ambiguity.**
1	**Student solves some of the problem incorrectly.** **Student uses little math vocabulary.** **Student does not use drawings, labels, tables, or diagrams.** **Student thinking is not clearly explained.**
0	**Student does not solve the problem correctly.** **Student does not use math language.** **Student does not use drawings, labels, tables, or diagrams.** **Student does not explain the answer.**